23MCPE673

MANGALORE INSTITUTE OF TECHNOLOGY & ENGINEERING

(A Unit of Rajalaxmi Education Trust®, Mangalore)
Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE, New Delhi
Accredited by NAAC with A+ Grade & ISO 9001:2015 Certified Institution

Model Question Paper

Fourth Semester MCA Degree Examination

Augmented Reality and Virtual Reality

Time: 3 Hours **Max. Marks: 100**

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M: Marks, L: RBT (Revised Bloom's Taxonomy) level, C: Course outcomes.

		Module -1	M	L	C
Q1	a.	Describe the concept of Virtual Reality and outline its fundamental characteristics. Summarize how modern VR experiences in fields such as gaming, virtual tourism, and professional training demonstrate the principles of immersion and interaction. Discuss the contribution of human sensory systems—vision, hearing, and proprioception—in creating a realistic sense of presence in virtual environments.	10	L2	CO1
	b.	Trace the historical development of Virtual Reality by describing key milestones—from early inventions like Sensorama and The Sword of Damocles to contemporary systems like Oculus Rift and HTC Vive. Interpret how advancements in hardware components such as head-mounted displays, motion tracking, and haptic feedback have enhanced user immersion over time.	10	L2	CO1
		OR			
Q2	a.	Identify and classify the major hardware and software components required in a typical VR system. Discuss the roles of rendering engines (e.g., Unity, Unreal Engine), input devices, display technologies, and tracking systems. Illustrate how these components work together to support real-time interaction and user engagement.	10	L2	CO1
	b.	Discuss how the human visual, auditory, and vestibular systems influence the design of VR environments. Describe the phenomenon of sensory conflict and its impact on user comfort. Outline the software and hardware strategies used to reduce motion sickness and support natural perception in virtual experiences.	10	L2	CO1
		Module- 2			
Q3	a.	A software company is designing a VR-based training application for elderly users. Apply the principles of human information processing and perception to suggest three interface design modifications that would improve usability. Show how cognitive load can be reduced using real-world interface examples.	10	L3	CO2
	b.	You are tasked with redesigning a mobile banking app to improve user experience. Use the general principles of Human-Computer Interaction (HCI) to implement three design changes based on physical ergonomics and user cognition. Illustrate each change with a sketch or scenario showing improved interaction.	10	L3	CO2
		OR			
Q4	a.	A team is developing a cockpit interface for pilots. Choose three HCI guidelines related to perception and cognition, and apply them to model a dashboard layout that minimizes error and supports quick decision-making. Show how sensory limitations and attention spans are addressed in your design.	10	L3	CO2
	b.	In a virtual classroom application, users report fatigue and difficulty navigating menus. Relate these issues to principles of physical ergonomics and information processing. Propose and operate a revised interaction model (e.g., voice commands, gesture-based navigation) that applies HCI guidelines to solve these problems.	10	L3	CO2
		Module - 3			
Q5	a.	A VR headset design team observes that users report blurred vision and eye strain. Apply your understanding of optical aberrations and the structure of the human eye to identify three likely	10	L3	CO3

		causes. Show how lens design and display positioning can be modified to reduce chromatic aberration and accommodate varying user pupillary distances.			
	b.	You are tasked with improving the visual clarity of a near-eye display in an AR headset. Use the principles of light behavior and lens focusing to model an optical path that minimizes spherical aberration and ensures sharp image projection on the retina. Illustrate your design with labeled ray diagrams and justify your lens choices.	10	L3	CO3
OR					
Q6	a.	In a virtual reality driving simulator, users experience motion sickness and difficulty judging distances. Apply knowledge of human eye movements (such as saccades, vergence, and accommodation) to show how mismatch between visual cues and physical responses contributes to these issues. Propose and implement two display or rendering adjustments to better align with natural visual physiology.	10	L3	CO3
	b.	A new VR system uses camera-captured real-world lighting to enhance realism. Choose appropriate optical principles (e.g., reflection, refraction, focal length) and apply them to configure the camera and display system for accurate light reproduction. Show how this setup supports photorealistic rendering while minimizing latency and visual fatigue.	10	L3	CO3
Module - 4					
Q7	a.	A VR game developer notices that players have difficulty judging distances and perceive objects as "flat." Apply principles of depth perception (e.g., binocular cues, motion parallax, occlusion) to design a scene update that enhances 3D realism. Show how rendering techniques like stereoscopic rendering and depth-of-field shading can be implemented to support these perceptual cues.	10	L3	CO4
	b.	Users report that fast motion in a VR rollercoaster simulation appears blurry and causes discomfort. Use your understanding of motion perception and frame rendering to model a solution that improves motion clarity. Show how increasing frame rates, reducing latency, and applying motion blur shaders can be used to align the visual experience with human perceptual expectations.	10	L3	CO4
OR					
Q8	a.	In a virtual art gallery, visitors complain that colors appear unnatural and inconsistent under different lighting. Choose appropriate color perception principles (e.g., color constancy, opponent process) and apply them to reconfigure the shading model in the rendering pipeline. Illustrate how gamma correction and physically based rendering (PBR) can be used to achieve realistic color representation across displays.	10	L3	CO4
	b.	An immersive 360° video application suffers from visible pixelation and optical distortions near the edges. Apply techniques for correcting lens distortion and enhancing rendering performance. Illustrate how pre-warping video frames, optimizing rasterization, and using adaptive resolution rendering can improve visual quality while maintaining high frame rates.	10	L3	CO4
Module - 5					
Q9	a.	A VR meditation app uses ambient sounds, but users report that audio feels "flat" and fails to enhance immersion. Apply principles of auditory perception (e.g., binaural hearing, sound localization, head-related transfer functions) to design a 3D audio layout. Show how auditory rendering techniques can be implemented using spatial audio engines (e.g., Steam Audio, Facebook 360 Spatial Workstation) to create a realistic sense of space.	10	L3	CO4
	b.	Users of a VR flight simulator experience dizziness and nausea during prolonged use. Choose three evidence-based recommendations for developers to reduce VR sickness. Show how modifying motion acceleration curves, optimizing audio-visual synchronization, and adjusting field of view dynamically can be applied to improve user comfort and reduce sensory conflict.	10	L3	CO4
OR					
Q10	a.	You are leading a team to evaluate a new VR training module for warehouse workers. Use established experimental methods for human subject testing to model a study design that assesses usability, comfort, and task performance. Illustrate how metrics like simulator sickness questionnaire (SSQ), task completion time, and user feedback can be implemented to gather valid results.	10	L3	CO4
	b.	In a VR horror game, jump scares are not perceived as expected—some users hear sounds too early or from incorrect directions. Apply the physiology of human hearing and auditory latency thresholds to modify the audio rendering pipeline. Show how synchronizing audio cues with visual events and using HRTF-based rendering can enhance realism and emotional impact.	10	L3	CO4

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